IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : S.R. Narayanan et al. Art Unit : 1745
Serial No.: 09/489,514 Examiner : Julian Mercado
Filed : January 21, 2000
Title : MEMBRANE-ELECTRODE ASSEMBLIES FOR DIRECT METHANOL FUEL CELLS

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Commissioner for Patents
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BRIEF ON APPEAL

Sir: Applicant herewith file this brief on appeal under 37 CFR 41.37. The sections required by that CFR section follow.

(1) Real Party in Interest

The patent application is assigned to California Institute of Technology who is believed to be the real party in interest. Under the terms of an agreement between California Institute of Technology and University of Southern California, the latter University of Southern California may also have certain rights in the subject matter of this invention.

(2) Related Appeals and Interferences

There are no known related appeals or interferences.

(3) Status of Claims

Claims 7-10 and 12-26 are pending in the case. Each of these claims are herewith rejected.

(4) Status of Amendments

A final rejection was mailed on May 25, 2006. No response subsequent to the final rejection has been filed.

(5) Summary of Claimed Subject Matter

Claim 7 defines a process for forming a catalyst ink for a fuel cell. This is described in many places within the specification, including page 4 line 21. Claim 7 requires mixing components at room temperature (see page 6 lines 3-4) including water, fluorocarbon, (see page 4 lines 29-31), an ionomer (see page 5 lines 4-10) and a catalytic material (see page 4 lines 25-28). The particles are randomly spaced and uniformly mixed, see page 6 lines 20-21.

Claim 13 also defines a process for forming an electrode assembly, in which a catalyst ink is formed with water, particles of fluorocarbon, ionomer and catalytic material (see page 4 lines 25-31, page 5 lines 4-10 and page 6 lines 3-4). Claim 13 requires preparing a substrate of carbon fiber paper (see page 5 line 27-31) and applying the material onto the substrate (see page 6 lines 1-5).

Claim 18 defines providing a catalyst ink which is formed with water, particles of fluorocarbon, ionomer and catalytic material (see page 4 lines 25-31, page 5 lines 4-10 and page 6

lines 3-4). Applying the catalyst ink at room temperature (see page 6 lines 1-2) and bonding the membrane to at least one electrode (see page 6 lines 30-31).

Claim 20 requires a cathode with a membrane that has a catalyst ink formed with water, particles of fluorocarbon, ionomer and catalytic material (see page 4 lines 25-31, page 5 lines 4-10 and page 6 lines 3-4). Claim 20 also requires electrode, anode and cathode and membrane. See page 6 line 33 page 7 line 4.

(6) Grounds of Rejection

Is Claim 18 properly rejected under 35 USC 101 as being directed to nonstatutory subject matter?

Is Claim 18 properly rejected under 35 USC 112 as being indefinite?

Are Claims 7-10, 13, 14, 18, 20 and 23-26 properly rejected under 35 USC 103 as being obvious over Serpico et al. in view of the Dupont Zonyl reference and Trainham III et al?

Is Claim 12 properly rejected over Serpico et al. in view of the Dupont Zonyl reference and Trainham III et al., and further in view of Kindler?

Are Claims 15-17, 19, 21 and 22 properly rejected over Serpico et al. in view of the Dupont Zonyl reference and Trainham III et al., and further in view of Samuels et al?

(7) Argument

Rejections under section 101

Claim 18 stand rejected under 35 USC 101 as allegedly being directed to non-statutory subject matter. This contention is respectfully traversed. The rejection alleges that the claim crosses statutory boundaries since 35 USC 101 permits patents only for one statutory class of invention. This contention is not legally correct.

Note that the classes of permissible claims include process, machine, manufacture or composition of matter. Initially, the undersigned believes that there is no legal support for the patent office's contention that overlapping two different statutory classes of invention violates section 101. In fact, this expressly contradicts many of the cases which held that in using the terms that were used in section 101 that Congress intended the classes of patentability to have a broad scope. See, for example, Pioneer Hi-Bred International, Inc. v. JEM Agricultural Supply, Inc., 200 F.3d 1374 (Fed Cir 2000).

The intent was clearly that all inventive works of mankind be covered, not only those that fall within a specified category.

Therefore, the contention that a permissible claim can only contemplate one class is legally incorrect.

Even if correct, however, each element of Claim 18 defines a single class - here a process. There is absolutely no support in the statute that somehow a process of making is different than a process of using. Even if somehow the statute can be contended as requiring that something only be a process and not a machine etc., the statute certainly does not limit a claim to only a process of making, to the exclusion of only a process of using. With all due respect, the rejection under section 101 is legally incorrect and should be reversed.

Rejections under Section 112

Claim 18 is alternatively rejected based on 35 USC 112, second paragraph as allegedly being indefinite. The rejection alleges that a manufacturer or seller would not know the meets and bounds of the claim. With all due respect, this is further incorrect. Claim 18 requires providing an ink, applying the ink, bonding the membrane to an electrode, and using the membrane as a cathode of a direct methanol fuel cell. A seller or manufacturer would certainly understand, to the extent they

can read claims, how to avoid coming within the scope of this claim. The contention that a person would not be able to understand whether they did or did not infringe this claim is not supported. Certainly, they could understand the steps, independent of whether they were for "making" and/or "using".

The contention about referring to the claim as plural processes is further respectfully traversed. Claims are claimed as combinations. Whether the combination is one process or multiple processes says nothing about the way in which the claim should be drafted.

Rejections under Section 103

Claims 7, 8, 10, 13, 14, 18, 20 and 23-26 stand rejected under 35 USC §103(a) as allegedly being unpatentable over Serpico et al. in view of the Zonyl reference and further in view of Trainham, III et al. This contention is respectfully traversed, and for reasons set forth herein, the combination is made based entirely on hindsight.

The rejection admits that Serpico et al. does not teach explicitly adding an ionomer to the catalyst ink. The rejection uses Trainham, III et al., which does show using a Nafion ionomer in a catalyst ink, see column 8 lines 9-24. However, the reason for adding the Nafion ionomer in Trainham, III et al.

is "to enhance the catalyst-ionomer surface contact and to act as a binder to the Nafion membrane sheet". That is, Trainham, III et al. does teach adding Nafion, but teaches adding Nafion only as a binder. Therefore, there is no teaching or suggestion in Trainham, III et al. which would lead a person of ordinary skill in the art to the claimed subject matter of adding an ionomer with "a property of improving ion conduction". The ionomer in Trainham, III et al. is only added for the purpose of improving binding, not for improving ion conduction.

For these reasons, a person having ordinary skill in the art would not operatively make the combination of Serpico et al. in view of Zonyl and further in view of Trainham, III et al. The reasons for making this combination are those set forth in the present specification, not the prior art. The teaching in Trainham, III et al. would not lead a person having ordinary skill in the art to make this combination.

Many of the dependent claims should also be allowable for analogous reasons. Claims 23-26 define that the ionomer is Nafion configured as an ion conducting material. Nowhere does the prior art teach or suggest this feature. At least one form of Nafion allows the material to operate as an ion exchange material, not ion conduction. The configuration of Nafion is in no way taught or suggested. Claims 23-26 should hence be

allowable for these reasons.

Claim 13 defines a catalyst ink with water, ionomer, and a catalytic material with platinum and another catalytic material. Carbon fiber paper is also prepared by adding fluorocarbon polymer. There is no teaching or suggestion of this combination in the cited prior art. Therefore, the claims of this type, including Claims 13, 18 and 19, which define a substrate of carbon fiber paper that has fluorocarbon polymer added thereto, should be additionally allowable for these reasons.

The dependent claims should be allowable by virtue of their dependencies, and the additional references to Kindler and Samuels et al. do not suggest these features.

Please apply the brief fee of $250, and any other applicable charges or credits, to Deposit Account No. 06-1050.

Respectfully submitted,

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Appendix of Claims

1-6. (Canceled).

7. (Previously presented) A process for making a catalyst ink for a fuel cell, comprising mixing, at room temperature, components comprising water, particles of a fluorocarbon polymer with a particle size of 1 to 4 microns, an ionomer which has a property of improving ion conduction, and a catalytic material including platinum and which are randomly spaced and uniformly mixed.

8. (Previously Presented) The process of claim 7, wherein the particles have a surface area of about 5 to about 10 m^2/g.

9. (Previously presented) The process of claim 7, wherein the catalytic material comprises 60% platinum and 40% ruthenium.

10. (Previously Presented) The process of claim 7, wherein the fluorocarbon polymer is selected from the group consisting of polytetrafluoroethylene polymers and fluorinated ethylene-propylene polymers.

11. (Canceled).

12. (Previously presented) The process of claim 7, wherein the ionomer comprises a liquid copolymer of tetrafluoroethylene and perfluorvinyletherosulfonic acid.

13. (Previously presented) A process for making an electrode assembly for a fuel cell, comprising:

(a) providing a catalyst ink comprising water, particles of a fluorocarbon polymer with a particle size of 1 to 4 microns, an ionomer which has a property of improving ion conduction, and a catalytic material including platinum and another catalytic material, which are randomly spaced and uniformly mixed;

(b) preparing a substrate of carbon fiber paper, by adding fluorocarbon polymer to the carbon fiber paper; and

(c) applying the catalyst ink at room temperature to at least one side of said substrate.

14. (Previously Presented) The process of claim 13, wherein the substrate has said fluorocarbon polymer as 5 wt %.

15. (Previously Presented) The process of claim 14, further comprising roughening the side of the membrane prior to applying the catalyst ink.

16. (Previously Presented) The process of claim 15, wherein the side of the membrane is roughened by contacting the membrane with an abrasive selected from the group consisting of silicon nitride, boron nitride, silicon carbide, silica and boron carbide.

17. (Previously Presented) The process of claim 16, wherein the abrasive has a grit size of about 300 to about 400.

18. (Previously Presented) A process comprising:

(a) providing a catalyst ink comprising particles of a fluorocarbon polymer with a particle size of 1 to 4 microns, an ionomer which has a property of improving ion conduction, and a catalytic material including platinum and another catalytic material, randomly spaced and uniformly mixed;

(b) applying the catalyst ink at room temperature to at least one side of a membrane;

(c) bonding the membrane to at least one electrode and using said membrane as a cathode of a direct methanol fuel cell.

19. (Previously Presented) The process of claim 18, further comprising roughening the side of the membrane prior to applying the catalyst ink.

20. (Previously presented) A fuel cell comprising:

a cathode having a membrane, a catalyst ink comprising particles of a fluorocarbon polymer with a particle size of 1 to 4 microns, an ionomer which has a property of improving ion conduction, and a catalytic material including platinum and another catalytic material, which are randomly spaced and uniformly mixed and bonded to the membrane; and

at least one electrode; a solid polymer electrolyte membrane, bonded to said cathode, and an anode bonded to said solid polymer electrolyte membrane, said anode, cathode and solid polymer electrolyte membrane collectively forming a membrane electrode assembly.

21. (Previously Presented) A fuel cell as in claim 20, wherein said applying further comprises roughening said at least one side of the membrane prior to applying the catalyst ink.

22. (Previously Presented) A process as in claim 18, wherein said applying comprises roughening said one surface prior to applying the catalyst ink.

23. (Previously presented) A process as in claim 7, wherein the ionomer is Nafion configured as an ion conducting material.

24. (Previously Presented) A process as in claim 13, wherein said ionomer is Nafion configured as an ion conducting material.

25. (Previously Presented) A process as in claim 18, wherein said ionomer is Nafion configured as an ion conducting material.

26. (Previously Presented) A fuel cell as in claim 20, wherein said ionomer is Nafion configured as an ion conducting material.

Evidence Appendix

None.

Related Proceedings Appendix

None.